

10/772,473

TASKP103US

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Date: March 3, 2008 
Rebecca A. Bellas

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re patent application of:

Applicant(s): Bokisa, *et al.*

Serial No: 10/772,473

Filing Date: February 5, 2004

Examiner: Edna Wong

Art Unit: 1753

Title: NICKEL COBALT BORON TERNARY ALLOYS

**Mail Stop Appeal Brief – Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450**

APPEAL BRIEF

Dear Sir:

Appellants' representative submits this brief in connection with an appeal of the above-identified patent application and in response to the Notice of Non-Compliant Appeal Brief dated February 11, 2008. In the event any additional fees may be due, the Commissioner is authorized to charge such fees to Deposit Account No. 50-1063.

I. Real Party in Interest (37 C.F.R. §41.37(c)(1)(i))

The real party in interest in the present appeal is Taskem, Inc., the assignee of the present application.

II. Related Appeals and Interferences (37 C.F.R. §41.37(c)(1)(ii))

Appellants, appellants' legal representative, and/or the assignee of the present application are not aware of any appeals or interferences which may be related to, will directly affect, or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. Status of Claims (37 C.F.R. §41.37(c)(1)(iii))

Claims 14, 16-22, and 25 have been cancelled. Claims 1-13, 15, 23, 24 and 26-29 stand rejected by the Examiner. The rejection of claims 1-13, 15, 23, 24, and 26-29 is being appealed.

IV. Status of Amendments (37 C.F.R. §41.37(c)(1)(iv))

Claim amendments were made subsequent to the Final Office Action dated December 13, 2006, to rectify informalities and a rejection under 32 U.S.C. § 112, second paragraph. These subsequent amendments have been entered for the purposes of appeal.

V. Summary of Claimed Subject Matter (37 C.F.R. §41.37(c)(1)(v))**Independent Claim 1**

Independent claim 1 relates to a method for electroplating a ternary alloy of nickel, cobalt, and boron. The method requires providing an electroplating bath containing an anode, a cathode, and water, wherein the water contains ionic nickel, ionic cobalt, an amine-borane compound selected from the group of dimethylamine borane, t-butylamine borane, and hydrates thereof, and at least one acetylenic

brightener. A current is applied to the electroplating bath whereby the ternary alloy forms on the cathode. (See, for example, page 2, lines 3-19).

Independent Claim 9

Independent claim 9 relates to a method for electroplating a ternary alloy of nickel, cobalt, and boron. The method requires providing an electroplating bath containing an anode, a cathode, and water, wherein the water contains ionic nickel, ionic cobalt, an amine-borane compound selected from the group of dimethylamine borane, t-butylamine borane, and hydrates thereof, and at least one acetylenic brightener. The electroplating bath contains about 40g/l or more and about 100g/l or less of the ionic nickel, about 1 g/l or more and about 30 g/l or less of the ionic cobalt, and about 0.1 g/l or more and about 10 g/l or less of the amine-borane compound, and from about 0.004% to about 2.5% by weight of the at least one acetylenic brightener. A current is applied to the electroplating bath whereby the ternary alloy forms on the cathode. (See e.g., page 2, lines 3-19; page 6, lines 11-21).

Independent Claim 26

Independent claim 26 relates to a method for electroplating a ternary alloy of nickel, cobalt, and boron. The method requires providing an electroplating bath containing an anode, a cathode, and water, wherein the water contains ionic nickel, ionic cobalt, an amine-borane compound selected from the group of dimethylamine borane, t-butylamine borane, and hydrates thereof, and at least one acetylenic brightener. The electroplating bath has a pH from about 3 to about 5 and a temperature from about 30°C to about 80°C. A current is applied to the electroplating bath whereby the ternary alloy forms on the cathode.

VI. Grounds of Rejection to be Reviewed (37 C.F.R. §41.37(c)(1)(vi))

A. Whether claims 1-8 and 23 are unpatentable under 35 U.S.C. § 103(a) as

being obvious over Japanese Patent Application JP 10-245693 (JP'693) in view of Passal (U.S. Patent No. 3,697,391).

- B. Whether claims 9-12, 15, and 24 are unpatentable under 35 U.S.C. § 103(a) as being obvious over Japanese Patent Application JP 10-245693 (JP'693) in view of Passal (U.S. Patent No. 3,697,391).
- C. Whether claim 13 is unpatentable under 35 U.S.C. § 103(a) as being obvious over Japanese Patent No. 10-245693 (JP'693) in view of Passal (U.S. Patent No. 3,697,391) and in further view of Soviet Union Inventor Certificate No. 1,544,847 (SU'847).
- D. Whether claims 26-29 are unpatentable under 35 U.S.C. § 103(a) as being obvious over Japanese Patent No. JP 10-245693 (JP'693) in view of Passal (U.S. Patent No. 3,697,391).

VII. Argument (37 C.F.R. §41.37(c)(1)(vii))

A. Rejection of Claims 1-8 and 23 Under 35 U.S.C. §103(a)

Claims 1-8 and 23 have been rejected under 35 U.S.C. §103 over Japanese Patent Application JP 10-245693 ("JP'693") in view of U.S. Patent No. 3,697,391 to Passal ("Passal").

JP'693 is directed toward a method for plating nickel or nickel binary alloys. JP'693 discloses a genus of quaternary amine salts (containing a pyridine moiety or nitrogen-containing heterocycle), which functions as surfactants and inhibits deposition of metal on insulating portions of electronic components.

Passal discloses a method for plating semi-bright or bright nickel, cobalt, or alloys of nickel and cobalt. Passal discusses four generic groups and ten specific compounds of primary brighteners, four generic groups and five specific compounds

five specific compounds of secondary brighteners, and twelve generic groups and seven specific compounds of auxiliary secondary brighteners. Passal teaches that any of the preceding brighteners requires the presence of a hydroxy-sulfonate compound to achieve reliable semi-bright and bright plating. Brighteners "used alone or in combination may produce no visual effect on the electrodeposits." Passal, col. 3., ln. 24-25.

Obvious determinations under § 103 are weighed after several factual determinations including (1) the scope and content of the prior art, (2) any differences between the claimed the claimed subject matter and the prior art, (3) the level of skill in the art, and (4) secondary considerations. *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 17-18 (1966).

a. Overview of the invention

The invention relates to making high quality (specifically, high surface specular reflection and/or mirror bright finish) nickel, cobalt and boron (Ni-Co-B) ternary alloys using a bath containing nickel ions, cobalt ions, an amine-borane compound, and an acetylenic brightener. Novelty is not disputed. The high quality Ni-Co-B alloys are achievable for two main reasons. First, the presence of an acetylenic brightener causes the uniform placement of metallic boron within the matrix of a Ni-Co alloy. This function is not trivial since the nickel and cobalt being plated are ionic while the boron being plated is not from an ionic source, but rather a complexed borane. See *infra* section VII(A)(c). Second, using a complexed borane instead of ionic boron provides a more attractive alloy because the boron plates in an electroless fashion with uniform distribution. However, when plating in an electroless fashion, there is an increased sensitivity to the remaining components of the bath because of potentially detrimental effects of components having undesirable oxidative/reductive properties.

b. The cited art does not teach or suggest each and every claim limitation.

Claim 1 recites a method for electroplating a Ni-Co-B ternary alloy having the

following acts:

- 1) providing an anode, a cathode, and water;
- 2) providing sources for metals being ionic nickel, ionic cobalt, and an amine-borane compound selected from one of dimethylamine borane, t-butylamine borane, and hydrates thereof;
- 3) providing an acetylenic brightener; and
- 4) applying a current to electroplate a ternary alloy.

JP'693 is largely directed toward plating elemental nickel or nickel alloyed with one of boron, cobalt, copper, iron, manganese, phosphorus, tin, or zinc. JP'693, para. [0007]. Table 1 of JP'693 appears to disclose four binary alloys (nickel/boron in number 4, nickel/copper in number 6, nickel/tin in number 10, and nickel/zinc in number 11) and no ternary alloys. The examples given in Table 1 are presumably provided to show the effectiveness of the disclosed quaternary amine additives in suppressing unwanted metal deposition in a range of systems. However, the examples do not encompass a process to electroplate a ternary alloy comprising nickel, cobalt and boron nor the formation thereof with mirror bright properties. This is because, in part, one cannot electroplate significant amounts of boron from boric acid into the crystal structure of an alloy.

Similarly, Passal is directed toward electroplating nickel, cobalt, or nickel-cobalt binary alloys. Passal, col. 2., ln. 23-24. There is no mention in Passal of any possibility of ternary alloys, whatsoever, nor any alloys containing boron. Moreover, because one cannot electroplate boron from boric acid into the crystal structure of an alloy, Passal fails to describe ternary alloys equivalent to those formed by the method of the claims.

Both JP'693 and Passal relate to electroplating metals. The claimed invention uses electroless boron plating to compliment the electroplating of nickel and cobalt. Both JP'693 and Passal fail to teach or suggest electroless boron plating.

Any boric acid present in JP'693 or Passal does not function to serve as a source of boron to form a ternary alloy or any other alloy. Boric acid is a buffering agent that dissociates into negatively charged borate. There is no electromotive force to cause

negatively charged borate to migrate toward a cathode and deposit thereupon, and in fact, no appreciable boron is formed in metal deposits from such plating systems. The Application, page 5, teaches that in "some instances [boric acid] may provide minor amounts of platable boron." This statement is referring to the possibility of borate ion in solution being trapped in a growing deposit at the cathode by occlusion. In any plating system, fast plating can lead to bath components and impurities becoming trapped in the deposit. However, such trapped bath components and impurities are not incorporated into the repeating crystal lattice structure of the alloy. Such occlusion is not equivalent to a uniform placement of boron within the crystal structure/crystal unit cell structure of an alloy, which occurs due to uniform placement of boron under electromotive force and reduction at the cathode.

An obvious rejection requires, *inter alia*, that the references in combination teach all of the claimed limitations. MPEP § 706.02(j). JP'693 and Passal contain no teachings regarding forming a ternary alloy of nickel, cobalt and boron nor providing a plating bath containing a nickel salt, a cobalt salt, and dimethylamine borane and/or t-butylamine borane as recited by claim 1. As such, the difference between the scope of the prior art and the claimed subject matter under the *Graham* factors is substantial. Therefore, the rejection should be reversed.

- c. The difference in the chemical mechanism between the prior art and the claimed invention does not allow for one having ordinary skill in the art to predict the performance of brighteners employed in the claimed invention.

Due in part to the lack of any teachings in JP'693 and Passal concerning Ni-Co-B ternary alloys, JP'693 and Passal provide no instruction regarding the selection of brighteners to obtain any improvement in electroplating such ternary alloys. A rejection under § 103 requires identifying "a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does." *KSR Int'l Co. v. Teleflex, Inc.*, 127 S. Ct. 1727, 1731 (2007).

The Examiner contends that modifying the method taught by JP'693 with the brighteners taught by Passal would be obvious to a person of ordinary skill since

“substituting the pyridinium salt brightener with an acetylenic brightener would have been functionally equivalent as taught by Passal.” (Final Office Action, June 15, 2006, page 6). The primary motivation cited by the Examiner is that “a skilled artisan in looking to develop a nickel-cobalt-boron alloy bath for use at an acidic pH would look at the additives in the prior art for their functioning in an electroplating bath.” (Advisory Action, June 26, 2007, p. 5).

Similar to the majority of process in the chemical arts, the successful performance of electroplating is unpredictable *a priori* and is often requires an iterative process to achieve success. Here, the claimed invention was motivated by a desire to identify conditions and brighteners suitable for plating a nickel-cobalt-boron alloy with a mirror bright finish over an extended range of current density, as demonstrated in Figure 4 of the Application. Presumably when the Examiner refers to “looking to develop a nickel-cobalt-boron alloy bath,” the motivation is similarly for a mirror bright finish over an extended range of current density, since a Ni-Co-B alloy can be obtained without the use of any brighteners (although the resulting alloy will be of an unacceptable quality). See Application, comparative example 1 (discussing a bath for forming a Ni-Co-B alloy without any brighteners).

The references, JP'693 and Passal, do not have any teachings regarding formation of a ternary nickel-cobalt-boron alloy nor using dimethylamine borane or t-butylamine borane as a boron source to form a nickel-cobalt-boron alloy. Formation of a ternary alloy, using amine-borane compounds, with mirror bright finish requires the uniform placement of boron within a matrix of a nickel-cobalt alloy in an electroless fashion. That is, the boron in an amine-borane compound, such as a dialkylamine borane, has no formal charge. However, boron is transported to the cathode for deposition through a metal borine radical ($\text{Ni}\cdot\text{BH}_3$ or $\text{Co}\cdot\text{BH}_3$) without boron undergoing formal oxidation or reduction. JP'693 and Passal fail to describe any boron source for making a ternary alloy wherein boron is uniformly incorporated in the alloy crystal structure.

JP'693 does not appear to have any concern or teachings regarding the

brightness of the deposited metal alloys discussed therein. JP'693 is directed towards deposition on electronic components for the prevention of solder encroachment. JP'693, para. [0002]. Since the deposited alloys are for the creation of solderable surfaces, presumably the aesthetic, mirror bright qualities of the electroplated alloy are not a concern. JP'693 only appears to be concerned with eliminating deposition on insulating surfaces and reducing plating time in order to minimize corrosion. The results of electroplating trials reported in Table 2 of JP'693 do not report the surface finish of the deposited metals; therefore, one having ordinary skill in the art has no ability to determine if the methods disclosed therein have any suitability for the problem of forming mirror bright finishes over an extended current density range.

As discussed, amine-boranes deposit on cathodes in an electroless fashion. All the various brighteners disclosed in Passal are all referenced in respect to deposition of nickel and cobalt in a manner requiring electro-oxidation/reduction from an extraneous EMF source. Therefore, the difference in the physical mechanism involved between the invention and Passal is substantial. There is little reason for one skilled in the art to believe that simple selection of brighteners from a prior art publication directed at the deposition of non-ternary, boron-free alloys would lead to success in forming ternary, boron-containing alloys.

Even without the large differences in the alloy composition, physical mechanism, and problems addressed among the invention and the references, the references themselves teach that the performance of brighteners is unpredictable. Passal states that "[w]hen used alone or in combination, a primary brightener may produce no visual effect on the electrodeposit or may produce semi-lustrous, fine-grained deposits." Passal, col. 3, ln. 24-26. Acetylenics are disclosed by Passal as an example of a primary brightener. Passal, col. 3, ln. 5. In fact, the entire teaching of Passal is directed towards the necessity of hydroxyl-sulfonate additives to more reliably produce bright deposits over a varying range of conditions and the insufficiency of primary brighteners in such regards. See Passal, col. 2, ln. 22-59. As noted, JP'693 does not contain any statements regarding the brightness of the metal deposits formed.

Therefore, neither reference provides any guidance concerning increasing specular reflection of Ni-Co-B ternary alloys. As such, the rejection should be reversed.

- d. The function of the brighteners disclosed in JP'693 are fundamentally different from those disclosed by Passal, and substitution of brighteners in the method of JP'693 with those of Passal serves to make the method of JP'693 inoperable.

The Examiner asserts that one having skill in the art is motivated to substitute and/or additionally add an acetylenic brightener taught in Passal since the "acetylenic brightener would have been functionally equivalent as taught by Passal." (Final Office Action, Jun. 15, 2006, page 6). The term brightener is used in the art in relation to additives that improve some desired aspect of electroplating performance; the term is not limited to agents that actually increase the specular reflectance of deposited metals.

The generic usage of the term "brightener" is apparent in both Passal and JP'693. Again, Passal states that "a primary brightener may produce no visual effect" at all. Passal, col. 3. ln. 24-25. A person having ordinary skill in the art will interpret this statement as meaning that some of the brighteners have no effect on specular reflection regardless of the concentration and other conditions used. "Brighteners" that do not increase specular reflection may have other useful effects such as acting as a surfactant and/or lowering surface tension, solubilizing materials, and tightening grain structure.

JP'693 discusses the role of the quaternary amine brighteners disclosed therein extensively, and at no point are the quaternary amines described as increasing brightness/specular reflection. The quaternary amines are believed by the authors of JP'693 to work as an "effective surfactant" that "can act to suppress the deposition of metal." JP'693, para. [0012]. That is, the surfactant quaternary amines coat the surfaces present in the bath due to the hydrophobic effect, thereby suppressing plating on those surfaces. The plating suppression effect is lost if "the number of carbon atoms is less than 6" in a required alkyl substituent of the quaternary amine brighteners, meaning that the suppression effect is tied into the quaternary amines having sufficient

amphiphilic character. JP'693, para. [0013]. In summary, the quaternary amine "brighteners" of JP'693 are fully described as being plating inhibitors and no discussion whatsoever is made regarding the ability of the quaternary amines disclosed therein to form plated metal surfaces with any particular specular reflectance properties.

Therefore, any substitution and/or addition of "brighteners" to the method of JP'693 is only "functionally equivalent," as argued by the Examiner, if such substitution and/or addition is of compounds that act as plating inhibitors. Again, JP'693 fully hypothesizes the function of the invention disclosed therein and states that amphiphilic character (in terms of an alkyl chain length of more than six carbons) is necessary for the functioning of the invention disclosed in JP'693. JP'693, para. [0012]. The acetylenics disclosed in Passal (e.g., N-1,2-dichloropropenyl pyridinium chloride, 2,4,6-trimethyl N-propargyl pyridinium bromide, 2-butyne-1,4-diol, proargyl alcohol, 2-methyl-3-butyne-2-ol, ect.) do not have any substituents having six carbon atoms or more; some acetylenics disclosed by Passal (and the Application) do not even have six carbon atoms in total. The inclusion of additives that do not have amphiphilic character goes directly against and contravenes the clear teaching of JP'693 in paragraph [0012]. Further, just as JP'693 contains no teaching regarding additives having a tendency to increase specular reflection, Passal has no teachings concerning additives having plating inhibition functionality as to prefer plating onto conducting surfaces relative to non-conductive surfaces. Passal has no teachings regarding plating onto non-conductive surfaces whatsoever.

Therefore, the Applicants strongly disagree with any assertion that the brighteners disclosed by JP'693 and Passal have any functional equivalency. The substitution of acetylenics disclosed in Passal into the method disclosed by JP'693 contravenes the explicit teachings of JP'693 and makes the method disclosed in JP'693 non-functional if such a substitution is performed. Further, there is no motivation to increase the aesthetic qualities of the alloys disclosed in JP'693 since JP'693 only relates to forming surfaces suitable for soldering. Soldering involves obscuring the surface with a soldering material, therefore, the aesthetic properties of the alloy are

irrelevant. Thus, the rejection should be reversed.

- e. Passal does not teach that a combination of pyridinium brighteners disclosed in JP'693 and the acetylenic brighteners disclosed in Passal yields improved deposits.

In the alternative, the Examiner asserts the following as a rationale to combine JP'693 and Passal:

"[E]ven if one having ordinary skill in the art did not replace a pyridinium brightener disclosed by JP'693 with a brightener disclosed by Passal, there was no reason why one having ordinary skill in the art could not have added a second brightener into the bath in addition to the pyridinium brightener disclosed by JP'693 because according to Passal, additives that work in combination give the best results." (Advisory Action, June 26, 2007, p. 4).

The Examiner appears to be asserting that since Passal teaches that "combination[s] give the best results," it is obvious to try all the compounds that appear in the prior art either singly or in combination. Again, the Examiner's assertion that "combination give[s] the best results" requires a determination as to the nature of "the best results." To the extent that "the best results" are increased surface brightness, there is no teaching in JP'693 or elsewhere in the art that the pyridinium compounds disclosed in JP'693 have any functionality in improving surface brightness. As such, there cannot be motivation to seek a combination of pyridinium and acetylenic brighteners to increase surface brightness.

Further, it is well-known in the art that the performance of plating baths is highly sensitive to the presence of all components. For example, a hypothetical plating bath containing ionic sources of X and Y with a brightener A may form X-Y alloy deposits with acceptable qualities. However, another hypothetical plating bath containing ionic sources of X and Y with a brightener A and a brightener B may form X-Y alloy deposits with unacceptable qualities. Any teaching in Passal that "combination give[s] the best results," appears to be referring to combinations of what Passal classifies as "primary

brighteners" and "secondary brighteners." Passal, col. 3, ln. 24-31. The pyridinium compounds of JP'693 do not fit any of the categories disclosed in Passal. A reference disclosure must be evaluated for all that it fairly teaches. *In re Bozek*, 416 F.2d 1385, 1390 (CCPA 1969). Passal also teaches that "when excessive amounts of primary brighteners are inadvertently added, the electrodeposit obtained may be as defective as that obtained when large amounts of metallic impurities are present." Passal, col. 2, ln. 9-13. That is, Passal does not teach that any, random combination of brighteners or greater quantity of brighteners leads to better results. Instead, Passal teaches that the quality of electrodeposits is sensitive to all bath components. Further, Passal's whole teaching is only that the inclusion of a hydroxyl-sulfonate generally improves the performance of the disclosed classes of brighteners, and Passal does not generally teach how any of the disclosed brighteners perform in systems other than the conditions disclosed in the examples. Passal, col. 2, ln. 40-59 and col 11, ln. 37 through col. 12, ln. 15. Therefore, Passal does not provide motivation to use a combination of pyridinium and acetylenic brighteners as argued by the Examiner.

- f. The performance of brighteners in the claimed invention is unpredictable; therefore, there is a lack of a finite number of predictable solutions to support a finding of obviousness.

The Court of Appeals for the Federal Circuit recently clarified the standard for obviousness in the chemical arts in *Takeda Chemical Industries, Ltd. v. Alphapharm Pty., Ltd.*, 492 F.3d 1350 (Fed. Cir. 2007). The Federal Circuit holds that an obvious to try standard is not equal to the requirements of § 103. *Id.* at 1359 ("[T]he fact that a combination was obvious to try *might* show that it was obvious under § 103.") (quoting *KSR*, 127 S. Ct. at 1732) (emphasis added). The court holds that "when there is a design need or market pressure to solve a problem and there are a *finite number* of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp." *Id.* (quoting *KSR*, 127 S. Ct. at 1732) (emphasis added).

In *Takeda*, the obviousness of a diabetes drug was in question, wherein the

patented drug was the result of a modification of a compound found in the prior art by substituting an ethyl substituent for an methyl substituent (in addition to a change in the alkyl substitution position on a heterocyclic ring). The resulting diabetes drug was found to be non-obvious due to the failure of the prior art to "identify predictable solutions for antidiabetic treatment" based, in part, on the unpredictable nature of chemical modifications. *Id.*; see also *id.* at 1361 (Alphapharm "failed to support a reasonable expectation to one of ordinary skill in the art that performing that chemical change would cause a compound to be more efficacious or less toxic.").

An analogous situation is presented by the present case. Here, Applicants claim a method for plating an alloy that is not found in either of JP'693 nor Passal, specifically a ternary alloy containing nickel, cobalt, and boron wherein the simultaneous deposition of boron occurs through an electroless mechanism of incorporating an amine-borane into a nickel-cobalt matrix. The motivation for identifying suitable brighteners was to achieve a mirror bright finish over an extended range of current density. The brighteners disclosed in JP'693 do not contain any teaching of their usefulness in achieving mirror brightness, and the description of the pyridinium brighteners clearly teaches their use as surfactants and plating blockers. Further, JP'693 counsels against the use of brighteners that do not meet the limitations delineated therein. JP'693, para. [0012]. Passal discloses several classes of brighteners without any teaching of which ones are or are not useful singly or in combination for the purpose of improving the brightness of nickel-cobalt alloys (nor nickel-cobalt boron ternary alloys), but only that the inclusion of a hydroxyl-sulfonate generally improves the performance of the disclosed classes of brighteners. Passal, col. 2, ln. 40-59 and col. 11, ln. 37 through col. 12, ln. 15.

In *Takeda*, there was no expectation of success in making small structural changes to the compounds of interest therein. Here, there is no expectation of success in choosing any particular brightener in the face of the difference between the chemistry of the invention and the chemistry of the prior art. Further, there is a large number compounds that have been used as brighteners beyond those disclosed in JP'693 and

Passal. The rejection using Passal and JP'693 is the result of impermissible hindsight, since there would be no expectation of success in adapting to a completely different electrochemical system. Without the benefit of the Applicants' disclosure, there is no reason why one having ordinary skill in the art would be directed toward the brighteners disclosed in Passal in view of the bewildering number of brighteners and additives existing in the prior art. That is, there is a lack of a "finite number of identified, predictable solutions [for which] a person of ordinary skill has good reason to pursue." *Takeda*, 492 F.3d at 1359 (quoting *KSR*, 127 S. Ct. at 1732)

In view of the above, the rejection should be reversed.

B. Rejection of Claims 9-12, 15 and 24 Under 35 U.S.C. §103(a)

Claims 9-12, 15 and 24 have been rejected under 35 U.S.C. §103 over JP'693 in view of Passal. The Examiner states that the rejection has been maintained for the same reasons as the rejection of claims 1-8 and 23. (Final Office Action, December 13, 2006, p. 12). In view of the above, the rejection should be reversed.

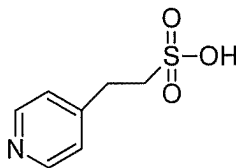
C. Rejection of Claim 13 Under 35 U.S.C. §103(a)

Claim 13 has been rejected under 35 U.S.C. § 103(a) as being obvious over JP'693 in view of Passal and in further view of Soviet Union Inventor Certificate No. 1,544,847 ("SU'847"). Claim 13, which depends from claim 9, recites the additional limitation of the electroplating bath containing a sulfo-betaine brightener in addition to the acetylenic brightener. The Examiner has rejected claim 13 for the same reasons as claims 1 and 9 with the additional argument that SU'847 discloses a suflo-betaine brightener.

SU'847 does not cure any of the deficiencies of JP'693 and Passal as discussed above; therefore, claim 13 is allowable for at least this reason. Further, SU'847 contains no disclosure regarding Ni-Co-B ternary alloys and only mentions plating nickel and nickel-cobalt alloys. Concerning any mention of boron nitride, boron nitride is not soluble and is present as a suspension of solids (boron nitride has two isomorphous forms

that individually have physical properties similar to diamond and graphite). As such, boron nitride cannot serve as a source of boron to form a true ternary alloy wherein individual atoms of boron are homogeneously spaced throughout the alloy lattice. SU'847 contains no discussion of amine-borane compounds as recited by the claims.

"During patent examination, the pending claims must be given their broadest reasonable interpretation consistent with the Application." *In re Hyatt*, 211 F.3d 1367, 1372 (Fed. Cir. 2000); MPEP § 2111. The Application discusses the structure of several sulfo-betaines represented by formulae I through VIII. All the formulae show the sulfur-containing substituent N-linked (the number 1 ring position) to a heterocycle (typically a pyridine ring). The 2-(4-pyridyl)ethanesulfonic acid disclosed by SU'847 has the sulfur-containing substituent attached to the number 4 position of a pyridine ring and is not N-linked. Further, formulae I through VII all show zwitterionic quaternary amines wherein the sole nitrogen atom is positively charged. The naming of 2-(4-pyridyl)ethanesulfonic defines a tertiary amine wherein the nitrogen atom is neutral. Under IUPAC nomenclature conventions, the number "2" in the compound of SU'847 refers to the pyridine ring being attached to the number 2 carbon of the ethane chain, where the sulfonic moiety is attached to the number 1 carbon of the ethane chain. The number "4" in the compound of SU'847 refers to the point of attachment of the pyridine ring at the number 4 carbon on the ring, where ring position number 1 is always the heteroatom, nitrogen, by convention. The structure of 2-(4-pyridyl)ethanesulfonic acid is as follows:



Therefore, the sulfa-betaine disclosed by SU'847 does not fit within any of formulae I-VIII and is outside a reasonable interpretation of claim 13 consistent with the Application.

In view of the above, the rejection should be reversed.

D. Rejection of Claims 26-29 Under 35 U.S.C. §103(a)

Claims 26-29 have been rejected under 35 U.S.C. § 103 over Japanese Patent JP 10-245693 ("JP'693") in view of U.S. Patent No. 3,697,391 to Passal ("Passal"). The Examiner states that the rejection has been maintained for the same reasons as the rejection of claims 1-8 and 23. (Final Office Action, December 13, 2006, p. 13). In view of the above, the rejection should be reversed.

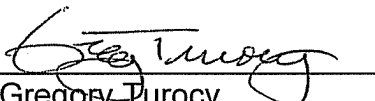
Additionally, claim 26 recites a pH range for the electroplating bath of about 3 to about 5. Table 1 of JP'693, no. 4, lists a bath containing ionic nickel and dimethylamine borane, to presumably form a Ni-B binary alloy, at a pH of 6. The pH of 6 is used by JP'693 in order to minimize the hydrolysis of dimethylamine borane. One having ordinary skill in the art would not deliberately contravene this clear teaching of JP'693 by employing an acidic pH in the range of 3-5 to plate dimethylamine borane. In view of this, the rejection should be reversed.

E. Conclusion

For at least the above reasons, the claims currently under consideration are believed to be patentable over the cited references. Accordingly, it is respectfully requested that the rejections of claims 1-13, 15, 23, 24, and 26-29 be reversed.

If any additional fees are due in connection with this document, the Commissioner is authorized to charge those fees to Deposit Account No. 50-1063.

Respectfully submitted,
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VIII. Claims Appendix (37 C.F.R. §41.37(c)(1)(viii))

1. (previously presented) A method of electroplating an alloy comprising nickel, cobalt, and boron comprising:

providing an electroplating bath comprising an anode, a cathode, water, ionic nickel, ionic cobalt, an amine-borane compound selected from the group consisting of dimethylamine borane, t-butylamine borane, and hydrates thereof, and at least one acetylenic brightener; and

applying a current to the electroplating bath whereby the alloy comprising nickel, cobalt, and boron forms on the cathode.

2. (previously presented) The method of claim 1, wherein the electroplating bath further comprises at least one sulfur containing brightener selected from the group consisting of sulfinic acids, sulfonic acids, aromatic sulfonates, aromatic sulfinates, sulfonamides, sulfonimides, sulfimides, and sulfo-betaines.

3. (previously presented) The method of claim 1, wherein the acetylenic brightener is selected from the group consisting of acetylenic alcohols, acetylenic amines, acetylenic esters, acetylenic sulfonic acids and sulfonates, alkoxyated acetylenic alcohols, and acetylenic carboxylic acids.

4. (previously presented) The method of claim 1, wherein the electroplating bath comprises about 40 g/l or more and about 100 g/l or less of ionic nickel, about 1 g/l or more and about 30 g/l or less of ionic cobalt, about 0.2 g/l or more and about 10 g/l or less of the amine-borane compound, and from about 0.001 % to about 5 % by weight of the at least one acetylenic brightener.

5. (previously presented) The method of claim 1, wherein the electroplating bath has a pH from about 2 to about 6 and a temperature from about 10 °C to about 90 °C,

and a current density of about 1 ASF or more and about 500 ASF or less is applied to the electroplating bath.

6. (previously presented) The method of claim 1, wherein the electroplating bath is provided by combining water; at least one nickel compound selected from the group consisting of nickel acetate, nickel acetylacetonate, nickel ethylhexanoate, nickel carbonate, nickel formate, nickel nitrate, nickel oxalate, nickel sulfate, nickel sulfamate, nickel sulfide, nickel chloride, nickel fluoride, nickel iodide, nickel bromide, nickel oxide, nickel tetrafluoroborate, nickel phosphide, and hydrates thereof; at least one cobalt compound selected from the group consisting of cobalt acetate, cobalt acetylacetonate, cobalt ethylhexanoate, cobalt carbonate, cobalt nitrate, cobalt oxalate, cobalt sulfate, cobalt chloride, cobalt fluoride, cobalt hydroxide, cobalt iodide, cobalt bromide, cobalt oxide, cobalt boride, cobalt tetrafluoroborate, and hydrates thereof; the amine-borane compound selected from the group consisting of dimethylamine borane, t-butylamine borane, and hydrates thereof; and the at least one acetylenic brightener.

7. (original) The method of claim 1, wherein the anode comprises at least one of nickel, cobalt, boron, iridium oxide, platinum, titanium, graphite, carbon, and platinum-titanium.

8. (original) The method of claim 1, wherein the nickel cobalt boron alloy comprises about 2 % by weight or less of components other than nickel, cobalt, and boron.

9. (previously presented) A method of forming an alloy comprising nickel, cobalt, and boron comprising:

providing an electroplating bath comprising an anode, a cathode, water, about 40 g/l or more and about 100 g/l or less of ionic nickel, about 1 g/l or more and about 30 g/l or less of ionic cobalt, and about 0.1 g/l or more and about 10 g/l or less of

platable boron from an amine-borane compound selected from the group consisting of dimethylamine borane, t-butylamine borane, and hydrates thereof, and from about 0.005 % to about 2.5 % by weight of at least one acetylenic brightener; and
applying a current to the electroplating bath whereby the alloy comprising nickel, cobalt, and boron forms on the cathode.

10. (previously presented) The method of claim 9, wherein the electroplating bath has a pH from about 3 to about 5 and a temperature from about 30 °C to about 80 °C, and a current density of about 10 ASF or more and about 200 ASF or less is applied to the electroplating bath.

11. (previously presented) The method of claim 9, wherein the electroplating bath further comprises at least one sulfur containing brightener selected from the group consisting of sulfinic acids, sulfonic acids, aromatic sulfonates, aromatic sulfinates, sulfonamides, sulfonimides, sulfimides, and sulfo-betaines.

12. (previously presented) The method of claim 9, wherein the acetylenic brightener is selected from the group consisting of acetylenic alcohols, acetylenic amines, acetylenic esters, acetylenic sulfonic acids and sulfonates, alkoxylated acetylenic alcohols, and acetylenic carboxylic acids.

13. (previously presented) The method of claim 11, wherein the sulfur containing brightener is a sulfo-betaine brightener.

14. (canceled)

15. (previously presented) The method of claim 9, wherein the electroplating bath further comprises at least one organic brightener selected from the group consisting of

ethylenic alcohols, coumarins, aldehydes, compounds containing a $C\equiv N$ linkage, and heterocyclics.

16. - 22. (canceled)

23. (previously presented) The method of claim 1, wherein the acetylenic brightener is selected from the group consisting of ethoxylated butynediol; 2-butyne-1,4-diol; propargyl alcohol; ethoxylated propargyl alcohol; hydroxyethyl propynyl ether; beta-hydroxypropyl, propynyl ether; gamma-propynyloxy, bis-beta-hydroxyethyl ether 2-butyne-1,4-diol; bis-beta-hydroxypropyl ether 2-butyne-1,4-diol; 1,4-di-(beta-hydroxyethoxy)-2-butyne; 1,4-di-(beta-hydroxy-gamma-chloropropoxy)-2-butyne; 1,4-di-(beta-gamma-epoxypropoxy)-2-butyne; 1,4-di-(beta-hydroxy-gamma-butenoxy)-2-butyne; 1,4-di-(2'-hydroxy-4'-oxa-6'-heptenoxy)-2-butyne; 2,4,6-trimethyl N-propargyl pyridinium bromide; 2-methyl-3-butyne-2-ol; 1-(beta-hydroxyethoxy)-2-propyne; and 1-(beta-hydroxypropoxy)-2-propyne.

24. (previously presented) The method of claim 9, wherein the acetylenic brightener is selected from the group consisting of ethoxylated butynediol; 2-butyne-1,4-diol; propargyl alcohol; ethoxylated propargyl alcohol; hydroxyethyl propynyl ether; beta-hydroxypropyl, propynyl ether; gamma-propynyloxy, bis-beta-hydroxyethyl ether 2-butyne-1,4-diol; bis-beta-hydroxypropyl ether 2-butyne-1,4-diol; 1,4-di-(beta-hydroxyethoxy)-2-butyne; 1,4-di-(beta-hydroxy-gamma-chloropropoxy)-2-butyne; 1,4-di-(beta-gamma-epoxypropoxy)-2-butyne; 1,4-di-(beta-hydroxy-gamma-butenoxy)-2-butyne; 1,4-di-(2'-hydroxy-4'-oxa-6'-heptenoxy)-2-butyne; 2,4,6-trimethyl N-propargyl pyridinium bromide; 2-methyl-3-butyne-2-ol; 1-(beta-hydroxyethoxy)-2-propyne; and 1-(beta-hydroxypropoxy)-2-propyne.

25. (canceled)

26. (previously presented) A method of electroplating an alloy comprising nickel, cobalt, and boron comprising:

providing an electroplating bath comprising an anode, a cathode, water, ionic nickel, ionic cobalt, an amine-borane compound selected from the group consisting of dimethylamine borane, t-butylamine borane, and hydrates thereof, and at least one acetylenic brightener, the electroplating bath has a pH from about 3 to about 5 and a temperature from about 30 °C to about 80 °C; and

applying a current to the electroplating bath whereby the alloy comprising nickel, cobalt, and boron forms on the cathode.

27. (previously presented) The method of claim 26, wherein the amine-borane compound comprises dimethylamine borane.

28. (currently amended) The method of claim 26, wherein the electroplating bath comprises about 40 g/l or more and about 100 g/l or less of ionic nickel, about 1 g/l or more and about 30 g/l or less of ionic cobalt, about 0.2

g/l or more and about 10 g/l or less of the amine-borane compound, and from about 0.001 % to about 5 % by weight of the at least one acetylenic brightener, and the electroplating bath further comprises at least one sulfur containing brightener selected from the group consisting of sulfinic acids, sulfonic acids, aromatic sulfonates, aromatic sulfinates, sulfonamides, sulfonimides, sulfimides, and sulfo-betaines.

29. (previously presented) The method of claim 26, wherein a current density of about 1 ASF or more and about 500 ASF or less is applied to the electroplating bath.

IX. Evidence Appendix (37 C.F.R. §41.37(c)(1)(ix))

None.

X. Related Proceedings Appendix (37 C.F.R. §41.37(c)(1)(x))

None.